Heart Repair with Human Tissue Engineered Myocardium

Grant Award Details

Heart Repair with Human Tissue Engineered Myocardium

Grant Type: Early Translational III

Grant Number: TR3-05556

Project Objective: Achieve a DC for heart failure to be delivered surgically. Plan includes patch generation and characterization as well as in vivo efficacy and preliminary safety work. Immune suppression regimen will be jointly developed between this award and DR2-05394.
DC to be a tissue-engineered patch of hESC-CM and mesechymal cells (fibroblast like per team) for heart failure.
POC testing to be performed in nude rat and after immunosuppresive regimen development, in pig, 1 month post MI.

Investigator:

Name:	Joseph Wu
Institution:	Stanford University
Type:	PI

,

Name:	Wolfram Zimmermann
Institution:	University Medical Center Goettingen
Type:	Partner-PI

Disease Focus: Heart Disease

Collaborative Funder: Germany

Human Stem Cell Use: Embryonic Stem Cell

Award Value: $4,396,738

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: Year 3

View Report

Grant Application Details

Application Title: Heart Repair with Human Tissue Engineered Myocardium

Public Abstract: Heart disease is the number one cause of morbidity and mortality in the US. With an estimated 1.5 million new or recurrent myocardial infarctions, the total economic burden on our health care system is enormous. Although conventional pharmacotherapy and surgical interventions often improve cardiac function and quality of life, many patients continue to develop refractory symptoms. Thus, the development of new therapies is urgently needed. “Tissue engineering” can be broadly defined as the application of novel bioengineering methods to understand complex structure-function relationships in normal or pathological conditions and the development of biological substitutes to restore, maintain, or improve function. It is different from “cell therapy”, which is designed to improve the function of an injured tissue by simply injecting suspensions of isolated cells into the injury site. To date, two main limitations of cell therapy are (1) acute donor cell death due to unfavorable seeding environment and (2) the lack of suitable cell type that genuinely resembles human cardiac cells. Our proposal seeks to use engineered tissue patches seeded with human embryonic stem cell-derived cardiomyocytes for treatment of ischemic heart disease in small and large animal models. It represents a significant development of novel techniques to address both of the main limitations of cell therapy, and will provide a new catalyst for the entire field of stem cell-based tissue engineering.

Statement of Benefit to California: Patients with end-stage heart failure have a 2-year survival rate of 25% by conventional medical therapy. Not commonly known to the public is that this dismal survival rate is actually worse when compared to patients with AIDS, liver cirrhosis, or stroke. Following a heart failure, the endogenous repair process is not sufficient to compensate for cardiomyocyte death. Thus, novel therapies with stem cells in combination with supportive scaffolds to form engineered cardiac tissue grafts is emerging as a promising therapeutic avenue. Engineered tissues have now been used to make new bladders for patients needing cystoplasty, bioarticial heart patches seeded with bone marrow cells, and more recently new trachea for patient with late stage tracheal cancer. Our multi-disciplinary team intends to push the therapeutic envelop by developing human tissue engineered myocardium for treatment of post-myocardial infarction heart failure. We will first test our engineered cardiac tissue in small and large animal models. We will perform extensive quality control measures to define morphological, molecular, and functional properties. At the end of 3 years, we are confident we will be able to derive a lead candidate that can move into IND-enabling preclinical development. These discoveries will benefit the millions of patients with heart failure in California and globally.